REMARKS

This is a responsive amendment to Office Action dated 24 October 2006 and subsequent to the interview conducted on 10 April 2007. The undersigned wishes to thank the examiner for allowing the inventor to appear at the recent interview. The interview summary indicates that the claims appeared allowable over the art of record.

The claims presented in the interview are the same as presented below.

Arguments made in the interview are also presented below. In the interview the inventor presented information about the catastrophic failures which had resulted from typical screw+ hardened washer devices and how fragments of the washer had shorted circuits in an ABS system. The genesis of the present invention, namely the need to prevent such catastrophic failures in the future led to the present solution which recognizes the counter intuitive use of a spring element of lower hardness than the screw element. Additional arguments are as follows:

The claimed invention differs from EP 0989311 in at least the following ways:

-the ring forming the spring element has a plurality of openings,

-the spring element is of lower hardness than the screw element, and

-the spring element has projections in the region of the workpiece contact.

The claimed invention differs from US 4,193,434 ("Wagner") in at least the following ways:

-the spring element is formed on the screw element in one piece,

-the spring element is of lower hardness than the screw element, and

-the spring element has projections in the region of the workpiece contact.

The claimed invention differs from US 6,302,629 ("Hsiao") in at least the following ways:

-the screw element has a spring element, and

-all other features related to the spring element are not disclosed in Hsiao disclosure because Hsiao does not teach a spring element at all.

Each of this differences is found in the claims as presented herein.

The claimed invention seeks to provide a screw which is specifically adapted to secure electric or electronic components made of soft materials. To achieve this objective it is important that the device be capable of providing

a screw connection which provides means to avoid loosening, and

the screw connection provides electrical contact.

A particular problem arriving in such specific application is caused by the rather soft material which is part of the screw connection on either one or both side. Resulting from this, it is not possible to apply high pre-stressing forces because this would damage the component. Additionally, the soft material tends to creep and thus there is a high risk that the screw connection gets loose.

To understand the problem the skilled person is confused when aiming to solve the above problems, it is important to recognize two basically different approaches when seeking to avoid loosening of screw connections:

First, it is important to maintain the pre-stressing effect of the screw connection by including elastic elements into the line of force so that it is prevented from dissipating

due to changes in length. In this case, it is required to include at least one elastic element in the line of force and the screw connection is not allowed to be stiff.

Second, it is known to provide a form of locking effect between the screw head and its underlyning surface. A number of geometries are known to achieve this effect but they all are based on a mechanism wherein shaped hatches mounted on the screw head dig into the counter face and thus a form locking effect is achieved. But note that these projections are affixed to hardened materials in order to achieve the locking effect. In the claimed invention, we are using lower hardness for the spring element , which is quite counter intuitive and novel.

Basically, the second approach is quite attractive for screw connections having soft counter faces because the digging-in could be easily achieved. However, the inventor of the present invention has recognized, that such deep digging-in often produces chips and larger particles which are released out of the counter face and which may severely deteriorate the function of the electronic circuit to which the electronic component is mounted.

Thus another approach for securing the soft material of electronic components in a safe manner had to be found. The inventor created as specific screw configuration having a spring element which is specifically adapted for securing soft materials of electronic components. The spring element is integrally connected to the screw. By this, the risk that the spring element geting lost in the course of assembling the component is avoided. Further, the force exerted by the spring element is reduced by providing a plurality of openings in a ring which forms the spring element. However, it was recognized, that still problems occur when using the such adapted screw.

Thus, an additionally manufacturing step was introduced to ***reduce the hardness*** *of the spring element so that its hardness* ***is lower than that of the screw*** element. By this, a spring element with specific characteristic, in particular with a rather small spring constant can be provided which is of particular advantage for the application.

Such a screw element can safely avoid loosening of the screw connection. However, it was determined that when using such designed screw element, the low forces exerted by the screw element against the counter face often is not sufficient to remove the oxide layer or other isolating surface layers so that no electrical contact is provided between the screw, the electrical component and the substrate into which the screw is screwed in.

To overcome this drawback the screw element according to the invention was further improved in that projections are provided on the spring element in the region of the workpiece contact. These projections are adapted to scrape through to the oxide layer of the counter-face or any other isolating layer in order to provide the electrical contact.

With regard to the Examiner's objections we want to comment as follows:

The Examiner objects to pending claim 7 to be unpatentable over EP 0 989 311 in view of Wagner, US 4,193,434. EP 0 989 311 and Wagner would disclose all features of pending claim 12 and EP 0 989 311 would disclose a spring element which is of lower hardness than the screw element. We have studied the disclosure of EP 0 989 311 A 1

but could not identify any passage which is directed to the spring element having a *lower hardness* than the screw element. In fact, the hardness of the spring element or the screw element is not discussed in EP 0 989 311 at all.

This feature, a spring element of lower hardness is objected to be not inventive by the Examiner. With regard to this feature the Examiner states that "there is a 'strong indication' that one skilled in the art would implicitly derive that the spring element, due to its 'spring like' characteristics and ability of bend back and forth as shown by the figures accompanying EP 0 989 311 would indeed be classified to one skilled in the art as having *a lower hardness* than the screw element".

The following technical aspects were identified to be considered when preparing this response to the argument of the Examiner:

- A *high elasticity* does not correlate with a *low hardness*. In contrast, a high elasticity usually correlates to a high hardness since a high hardness will avoid plastic (=irreversible) deformation, occurring in the course of bending back and forth.

- The Wagner patent involves as separate spring element which is not integral as called for in the claims. Furthermore it is silent as to its hardness, therefore, it must be presumed to follow ISO or ASTM standards.

- The inventor provides English language documents demonstrating and defining that prior art spring elements are *required to* have a high hardness and that in particular in the combination of a spring element and a screw it is usually intended to provide a spring element having a higher hardness than the screw element.

- In the course of making the invention, research within Ejot (the assignee company) has shown that due to *hydrogen diffusion* into the spring element the spring may become brittle and thus fail due to breakage.

- Further, research within Ejot has shown that the problem may be overcome by decreasing the hardness of the spring element below that of the screw element to avoid brittleness. In the course of this, a certain plastic deformation of the spring element is accepted. Research within Ejot has shown that after such plastic deformation the spring element will *still be able to elastically deform.* Prof. Friederich (inventor) has shown stress-strain diagrams demonstrating the behaviour of conventional spring elements of high hardness and spring elements as claimed with a low hardness.

- Further, it should be considered that an additional manufacturing step is required (inductive annealing) to provide the lower hardness in the spring element, making low hardness spring elements quite unobvious as they are not easy to achieve.

- Finally, carbon content of the spring element has to be lowered *contrary to usual composition* of screw materials to achieve the lower hardness of the spring element.

Beside this, there is a strong indication, that the skilled person would implicitly derive a completely *contrary teaching* (See MPEP sec 2143 above) from the EP 0 989 311 disclosure as to the hardness of the spring element. The reason, why the spring element is usually provided separately from the screw element is to allow for manufacturing the spring element from a specific steel which has a high Young's modules and hardness because this is particularly advantageous for the characteristics of the spring element. Even when manufacturing the spring element in one piece with the screw element the high grade of deformation which is required to form the spring element will result in significantly increased hardness of the spring element when compared with the screw element. To achieve elements of this invention, the inventor experimented to determine whether the elements of the invention would be effective in

achieving the objective (thus providing further proof that the invention cannot be made by merely combining random elements in a disparate group of prior art references).

With regard to pending claim 8 defining the spring element to have projections in the region of the work piece contact the Examiner takes the position that this claim would be unpatentable over EP 0 989 311 in view of Wagner and in further view of Hsiao.

To this it should be acknowledged that EP 0 989 311 and Wagner described the above described first approach to avoid loosening of a screw connection by maintaining the pre-stressing effect. In contrast to this, Hsiao discloses the second approach as described above in that specifically shaped projections are provided on the underside of a rigid ring attached to the screw head, wherein these projections are intended to dig into the counter-face and thus provide a form locking effect.

There is no suggestion to combine these two approaches. In particular, the technical function of the Hsiao screw requires a rigid and stiff ring in order to apply the forces which are required to let the projections dig into the counter-face. In contrast, such stiff and rigid ring could not be used in the screw element disclosed by Wagner or EP 0 989 311 because elasticity of the ring is required to provide the function of these screw connections.

The projections of the invention further are not intended to provide an anti-loosening effect since this is already done by the spring element itself. As said above, the projections of the screw element according to the invention only provide for an electrical contact and *thus do not have to dig into the counter-face as deep as in the*

Hsiao disclosure. By this, the production of chips can be avoided by the screw element according to the present invention.

CONCLUSION

Applicant will be submitting a *Declaration Of Heinrich Friederich Under Rule 1.132 document* for the Exmainer's review shortly.

In view of the amendments and reasons provided above, it is believed that all pending claims are in condition for allowance. The amendments clarify the patentable invention without adding new subject matter. Applicant respectfully requests favorable reconsideration and early allowance of all pending claims.

If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicant's attorney of record, Michael B. Lasky at (952) 253-4106.

Respectfully submitted,

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